Evolution of Climate Science Modelling Language within international standards frameworks

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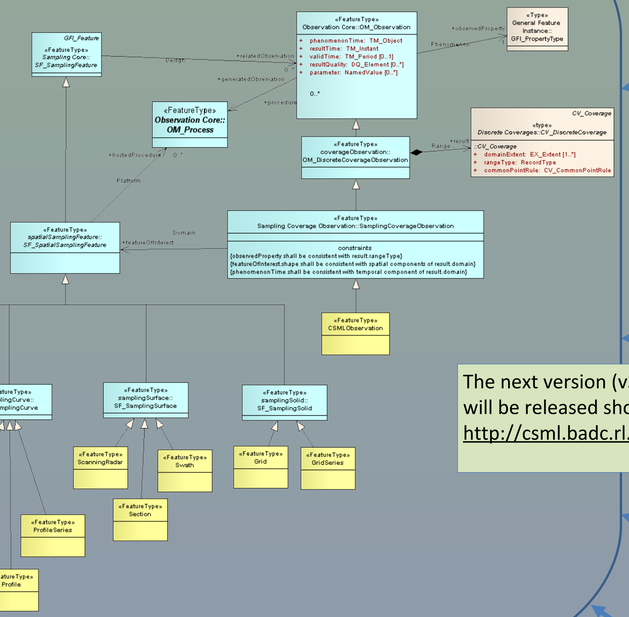
Observations & Measurements, ISO 19156

Climate Science Modelling Language (CSML) specialises Observations & Measurements to define a set of spatio-temporal sampling feature types suitable for describing a broad range of Met Ocean coverage observations.



The next version (v3) of CSML will be released shortly at http://csml.badc.rl.ac.uk

Point

based on	*SF_SamplingPoint*
phenomenonTime	*TM_Instant*
coverage result	CV_DiscretePointCoverage

A single observation at a point. E.g. Raingauge measurement

PointSeries

based on	*SF_SamplingPoint*
phenomenonTime	*TM_Period*
coverage result	CVT_DiscreteTimeInstant

A time-series of single datum observations at a fixed location. E.g. Tidegauge, buoy, weather station

Trajectory

based on	*SF_SamplingCurve*	
phenomenonTime	*TM_Period*	
coverage result	CV_DiscreteGridPointCoverage	
	grid dimension	*one*
	external CRS	*four (x-y-z-t)*

An observation along a discrete path in time and space e.g. aerosol measurements along an aircraft's flight path

Profile

based on	*SF_SamplingCurve*	
phenomenonTime	*TM_Instant*	
coverage result	CV_DiscreteGridPointCoverage	
	grid dimension	*one*

An observation of some parameter along a vertical line in space. E.g. Wind sounding or radiosonde.

ScanningRadar

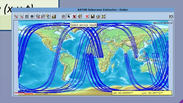
based on	*SF_SamplingCurve*	
phenomenonTime	*TM_Instant*	
coverage result	CV_DiscreteGridPointCoverage	
	grid dimension	*Two*

Backscatter profiles along a look direction at fixed elevation but rotating in azimuth. E.g. Weather radar

Swath

based on	*SF_SamplingSurface*	
phenomenonTime	*TM_Instant or TM_Period*	
coverage result	CV_DiscreteGridPointCoverage	
	grid dimension	*two*

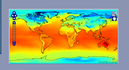
Two-dimensional grid of data along a satellite ground-path E.g. AVHRR satellite imagery



Grid

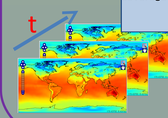
based on	*SF_SamplingSolid*	
phenomenonTime	*TM_Instant or None*	
coverage result	CV_DiscreteGridPointCoverage	
	grid dimension	*three*

Single time-snapshot of a gridded field.



GridSeries

based on	*SF_SamplingSolid*	
phenomenonTime	*TM_Period*	
coverage result	CV_DiscreteGridPointCoverage	
	grid dimension	*four*
	external CRS	*four (x-y-z-t)*



Time-series of gridded parameter fields. E.g. Numerical weather prediction model

Section

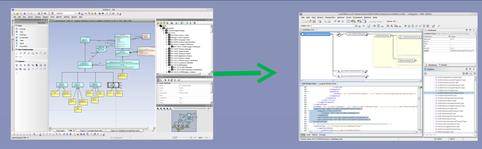
based on	*SF_SamplingSurface*	
phenomenonTime	*TM_Instant or TM_Period*	
coverage result	CV_DiscreteGridPointCoverage	
	grid dimension	*two*
	external CRS	*four (x-y-z-t)*

Series of profiles from a trajectory in time and space. E.g. marine CTD measurements along a ship's track

ProfileSeries

based on	*SF_SamplingCurve*	
phenomenonTime	*TM_Period*	
coverage result	CV_DiscreteGridPointCoverage	
	grid dimension	*two*
	external CRS	*four (x-y-z-t)*

Time-series of profiles on fixed vertical levels at a fixed location. E.g. vertical radar timeseries



Model driven architecture; Feature types are defined in Unified Modelling Language (UML), with GML[1] schema derived automatically from the UML model using tools such as FullMoon[2] or ShapeChange[3] (the ISO 19156 schema is almost finalised).Separating the modelling from the encoding in this way enables clear conceptualisation and simplified governance.

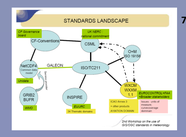
[1]: Geography Markup Language: http://www.opengeospatial.org/standards/gml
[2]: FullMoon: http://projects.arcs.org.au/trac/fullmoon/
[3]: ShapeChange: http://www.interactive-instruments.de/ugas/

CSML	CF/CDM
Point	Point
PointSeries	StationTimeSeries
Trajectory	Trajectory
Profile	Profile
ProfileSeries	StationProfile

CSML	CF/CDM
Swath	Swath
ScanningRadar	StationaryRadialSweep
Section	Collection of Profiles
Grid	Grid (single time)
GridSeries	Grid

Alignment with CF Point Observations; For several iterations now the Climate & Forecast (CF) conventions[4] for Point Observation and CSML have been converging on similar feature models. This version of CSML sees very direct mappings between CSML and CF Point Observations (see also the Unidata Common Data Model[5]). This will help bridge the gap between the NetCDF and file view of the world and the OGC feature and service views. http://cf-pcmdi.llnl.gov/

[4]: CF conventions: http://cf-pcmdi.llnl.gov/
[5]: :Unidate Common Data Model: http://www.unidata.ucar.edu/software/netcdf-java/CDM/



OGC Met Ocean Domain Working Group[6]; Working alongside the Meteorological, Oceanographic and Aviation communities within the Open Geospatial Consortium (OGC), the CSML modelling activity is helping to inform modelling activities across a broad range of use cases within the Met Ocean domain.

[6] OGC MetOcean DWG: http://external.opengeospatial.org/twiki_public/bin/view/MetOceanDWG/WebHome
[7] Image source: http://www.meteo.fr/cic/meetings/gis-ogc/Reports/ModelWGRP.pdf

CEDA OGC Web Services (COWS); COWS[8] has been developed by BADC to exploit CSML and other formats for OGC Service deployment. Above you can see CSML based services in use by the QUEST Earth System Data Initiative[9] (QESDI) project and the OGC Climate Challenge Integration Plugfest[10] (CCIP)

[8]: COWS - EGU 2010: http://meetingorganizer.copernicus.org/EGU2010/EGU2010-9325-1.pdf
[9]: QESDI - EGU 2010: http://meetingorganizer.copernicus.org/EGU2010/EGU2010-7038.pdf
[10]: CCIP: http://external.opengeospatial.org/twiki_public/bin/view/ClimateChallenge2009/WebHome

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